

REMARKS

A. Background

Claims 1-10, 12, 14-16 and 50-54 were pending in the application at the time of the Office Action. Claims 1-10, 12, 14-16 and 50-54 were rejected as being anticipated by and/or obvious over cited art. By this response applicant has amended claims 1-3, 5, and 6. As such, claims 1-10, 12, 14-16 and 50-54 are presented for the Examiner's consideration in light of the following remarks.

B. Amendments to the Claims

Applicant has herein amended claims 1-3, 5, and 6 to further clarify, more clearly define, and/or broaden the claimed inventions to expedite receiving a notice of allowance. For example, claims 1-3, 5, and 6 have all been amended to recite that the oscillation wavelength is determined by an optical phase determined by the effective cavity length and the length of the propagation region while a center wavelength of the stop band changes over temperature due to temperature dependence of the effective refractive index of the gain region. The amendments to the claims are supported in the application at least by Figure 3 and the corresponding discussion in the specification. Other amendments have also been made to the claims to remedy formal matters.

In view of the foregoing, applicant submits that the amendments to the claims do not introduce new matter and entry thereof is respectfully requested.

C. Examiner Interview

Applicant would like to thank the Examiner for the courtesy of the telephone interview conducted on October 23, 2009 between the undersigned and the Examiner of record in the present application. The purpose of the interview was to better understand the Examiner's rationale in rejecting the currently pending claims. During the interview the invention was discussed as set forth in the independent claims and contrasted that with the Numai reference. Specifically, the differences in stop bands and extended stop bands were discussed. No formal agreement was reached during the interview.

D. Rejections based on 35 U.S.C. § 103

1. Rejection based on Numai/Funabashi/Lo combination

Pages 2-13 of the Office Action reject claims 1-7, 9, 10, 14-16 and 50-54 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,501,776 to Numai (“*Numai*”) in view of U.S. Patent No. 6,580,740 to Funabashi (“*Funabashi*”) and further in view of U.S. Patent No. 5,617,436 to Lo (“*Lo*”). In light of amendments made herein, Applicant respectfully traverses this rejection and submits that a *prima facie* case of obviousness has not been established at least because the allegedly obvious combinations do not include each and every claim limitation recited in the rejected claims. Of the rejected claims, claims 1-3, 5, and 6 are independent claims.

Numai discloses a semiconductor laser that is temperature insensitive. See Title. In *Numai*, the “effective refractive index” is stabilized over temperature by canceling a positive refractive index temperature coefficient on an active layer with a negative refractive index temperature coefficient on a compensation layer, in order to stabilize the oscillation wavelength.

In contrast, the oscillation wavelength of the present invention, as defined by the currently amended claims, is not determined by the effective refractive index. Instead, the oscillation wavelength is “determined by an optical phase determined by the effective cavity length and the length of the propagation region,” as recited in all of the pending independent claims. In fact, in contrast to *Numai*, in the claimed inventions the “effective refractive index” in the gain region changes over temperature; as a result, the Bragg wavelength (the center wavelength of the stop band) and the stop band change over temperature as amended in the claims and as shown in Fig. 3 of the present application. In the present invention, by extending the stop bandwidth, a range for compensating the oscillation wavelength is extended, which is not taught in any of the cited references.

As Applicant discussed in a prior response of June 15, 2009, *Numai* does not disclose or suggest an extended stop bandwidth. Applicant further submits that it would not have been obvious to modify *Numai* to include an extended stop bandwidth. As noted in the June 15th response, the presently claimed inventions include an extended stop bandwidth and *Numai* does not. Applicant submits that even if a stop bandwidth is extended based on the structure disclosed in *Numai*, the compensation range would not be extended. As such, there is no motivation for a person skilled in the art to modify the diffraction grating in *Numai* with a high coupling coefficient based on the

teachings of *Lo* reference. The following are reasons why the compensation range is not extended in *Numai* even if a stop bandwidth were to be extended.

The section of *Numai* referred to by the Examiner recites: “In the DFB-LD, the oscillation wavelength is either one of wavelengths on opposite ends of its stop band when reflectivities at opposite facets of the device are negligibly small and no phase shift section is formed in the diffraction grating 25.”

As such, the recited section states that the oscillation wavelength is one of the wavelengths on either of the opposite ends of its stop band, meaning that the oscillation wavelength changes as its stop band moves. This is different from the claimed invention what is shown in Fig. 3 of the present application, where the oscillation wavelength does not change as the stop band moves. In *Numai*, the “effective refractive index” of the waveguide is stabilized and stability of the oscillation wavelength is hence achieved (see col. 12, lines 7-13). This means that the oscillation wavelength is stabilized, because the stop band is stabilized by the stabilized “effective refractive index” of the waveguide.

The section thereafter in *Numai* recites: “The oscillation wavelength is the Bragg wavelength determined by the grating pitch and the effective refractive index when a phase shift section (e.g., a $\lambda/4$ shift section) is formed in the diffraction grating 25.”

This section says that the oscillation wavelength is the Bragg wavelength determined by the “grating pitch” and the “effective refractive index” when a phase shift section is formed in the grating. It is a common technical knowledge in the art that the “grating pitch” hardly affects the oscillation wavelength over temperature due to negligible thermal expansion of semiconductor material. Hence, in this case, the oscillation wavelength is also determined by the “effective refractive index”. Therefore, in *Numai*, the “effective refractive index” is stabilized by canceling a positive refractive index coefficient on an active layer with a negative refractive index temperature coefficient on a compensation layer.

In either case, an extended stop bandwidth does not involve the stabilization mechanism for the oscillation wavelength. Thus, the compensation range is not extended or affected in *Numai* even if the stop bandwidth is extended. As such, Applicant submits that contrary to the rejection, one of skill in the art would not have found it obvious to modify *Numai* to have an extended bandwidth.

In light of the above, Applicant submits that a prima facie case of obviousness regarding claims 1-3, 5, and 6 has not been established at least because the Office Action has not shown that it

would have been obvious to combine the references in the allegedly obvious manner set forth in the Office Action, and because the Office Action has not shown that the allegedly obvious combination would include all of the limitations of the rejected claims. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 1, 2, 3, 5, and 6 be withdrawn.

Claims 4, 7, 9, 10, 14-16 and 50-54 variously depend from claims 1, 2, 3, 5, and 6 and thus incorporate the limitations thereof. As such, applicant submits that claims 4, 7, 9, 10, 14-16 and 50-54 are distinguished over the cited art for at least the same reasons as discussed above with regard to claims 1, 2, 3, 5, and 6. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 4, 7, 9, 10, 14-16 and 50-54 also be withdrawn.

2. Rejections based on further cited art

Pages 13 and 14 of the Office Action reject claims 8 and 12 under 35 U.S.C. § 103(a) as being unpatentable over the *Numai/Funabashi/Lo* combination, discussed above, further in view of U.S. Patent No. 4,583,227 to Kirkby (“*Kirkby*”) (claim 8) or U.S. Patent No. 5,719,974 to Kashyap (“*Kashyap*”) (claim 12). *Kirkby* is merely cited for allegedly teaching “the absolute value of a product of a length of the propagating region and a difference between a temperature differential coefficient of the effective refractive index of the gain region and a temperature differential coefficient of the effective refractive index of the propagating region is equal to or greater than $7.5 \times 10^{-4} \mu\text{m}/\text{K}$.” *Kashyap* is merely cited for allegedly teaching “the length of said propagating region is determined such that a longitudinal mode spacing determined by a sum of an effective length of the diffraction grating of said gain region and a length of said propagating region, is greater than a stop bandwidth of the diffraction grating.” Applicant respectfully traverses these rejections.

Claims 8 and 12 depend from claim 1 and thus incorporates the limitations thereof. As such, applicant submits that claims 8 and 12 are distinguished over the cited art for at least the same reasons as discussed above with regard to claim 1. Accordingly, Applicant respectfully requests that the obviousness rejection with respect to claims 8 and 12 also be withdrawn.

No other objections or rejections are set forth in the Office Action.

E. Conclusion

Applicant notes that this response does not discuss every reason why the claims of the present application are distinguished over the cited art. Most notably, applicant submits that many if not all of the dependent claims are independently distinguishable over the cited art. Applicant has merely submitted those arguments which it considers sufficient to clearly distinguish the claims over the cited art.

In view of the foregoing, applicant respectfully requests the Examiner's reconsideration and allowance of claims 1-10, 12, 14-16 and 50-54 as amended and presented herein.

In the event there remains any impediment to allowance of the claims which could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

Dated this 16th day of November 2009.

Respectfully submitted,

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